

[0031] FIG. 16 is a cutaway view from the rear of enclosures 28 and 30 to show the cooling devices disposed therein.

[0032] FIG. 17 is a diagrammatic front elevational view of the cabinet of this invention.

[0033] FIG. 18 is an elevational view of the far right interior door outer face and the far right exterior door inner face.

[0034] FIG. 19 is an interior view of the cabinet with both inner and outer doors removed.

[0035] FIG. 20 is a rear exterior door of an off the shelf Tesco Controls T-24-000 enclosure prior to the adaptation to this invention.

[0036] FIG. 21 is a rear exterior view of the cabinet of this invention.

[0037] FIG. 22 is a view related to FIG. 21.

[0038] FIG. 23 is a rear elevational view of this cabinet with the rear enclosures removed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0039] FORWARD—Applicants' assignee is not in the large electrical component business, wherein industry leaders include TOSHIBA, HITACHI, SIEMENS and GENERAL ELECTRIC. Rather applicants' assignee is an integrator. It is a specialty integrator for the water and wastewater industries. Its customers include water districts, such as the COACHELLA VALLEY WATER DISTRICT, and MUNICIPALITIES which distribute water and collect and treat wastewater. Applicants' assignee utilizes components from various manufacturers to create integrated systems for the movement (pumping) of water and the treatment thereof.

[0040] Thus applicant utilizes and often modifies electrical components of large electrical component manufacturers to operate in specific functions under certain operating parameters. Applicants' found that the KABUSHIKI, KAI-SHA TOSHIBA, hereinafter TOSHIBA, rectifier and transformer of U.S. Pat. No. 6,396,723 offered a full wire rectifier that converts three phase AC current into DC current, and that the transformer of this invention outputs AC of 6 phases. This apparatus is so constructed that the transformer used with the rectifier can be reduced relative to normal for an 18 pulse rectifier since the current flowing in the DC line through the transformer has been reduced. Less current equals less heat.

[0041] This patented apparatus was originally designed for use in the mining and oil and gas production industries. It was designed to operate at temperatures as high as 50° C., which is 122° F. The specification of the TOSHIBA patent U.S. Pat. No. 6,392,723 is herein incorporated by reference.

[0042] Water and wastewater operations are most often public entities, and as such are mandated to keep costs down, yet need to operate efficiently and reliably.

[0043] The mandate of applicants' was to determine how to take a very efficient variable frequency drive (VFD) that could operate under extreme conditions, and make it suitable for use by the water and wastewater industry without the need for refrigerated cooling. Thus the object of the project was to develop an enclosed, metered, low profile VFD for water and wastewater pump applications with no refrigerated cooling requirement. Thus the desire was to find a way to replace vertical VFDs with large refrigerated A/C units that require weather wrapping, or a shelter or building.

[0044] The object was to develop a VFD for the served industry that would have longer times between failures, and be more power efficient, which would result in a longer life industrial rated VFD to control variable speed pumps for use by the water and wastewater industry.

[0045] The completed drive of this invention consists of (A) the enclosure, (B) optional metering, (C) cooling elements, (D) optional control system and (E) the basic drive.

[0046] The enclosure employed, 11, is divided in two zones, the drive zone 13, and the transformer zone 14. The transformer zone has a single exterior door 12C, while the drive zone has double french type doors used since the doors are opposed in hinging, both closing to the center.

[0047] The basic housing is a free standing NEMA 3R cabinet, partially open at the bottom as will be discussed infra. We utilize a hot tipped galvanized steel construction, that is powder coated inside and out. A seamless construction is employed with all seams continuously welded and ground smooth. Housings of this type are designed to protect electrical and electronic controls, components and instruments in industrial environments. Enclosures of this type are available in various sizes to fit different needs. The modified housing of this invention can be seen generally in the top plan view FIG. 4 which shows the housing having two compartments with 3 enclosures attached to the two compartments.

Requirements of Various Customer Entities

[0048] As mentioned earlier, there are two zones to the enclosure. The main zone 13 holds the basic drive components, while the second or right side zone 14 holds the transformer utilized with the Toshiba supplied rectifier, a typical enclosure suitable for modification for use in this invention is a suitably sized TESCO CONTROLS T-24-000 enclosure.

[0049] Prior to discussing the two compartments of the apparatus, let us briefly visit FIG. 5. This FIG. 5 illustrates a generally rectangular metal beam base 60 having a concrete or metal floor sections 61 and 62. The base 60 is designed for disposition at the user's facility. A trio of power conduits face the gravel beneath for the feeding of conduits and power lines from a distance to the apparatus enclosure 11. Bases of this nature are conventional in the electrical utility industry as places through which electricity cables are brought to cabinets having components therein.

[0050] Referring now to FIG. 1 and FIG. 6, it is seen that the transformer zone 14 of the housing of this invention has a single outer door 12C, and a single full panel inner door 15C. See FIG. 14. Each of the two doors has a conventional handle closure, 16, thereon.

[0051] Exterior door 15C has at its lower end two areas of metal louvers in rectangular arrays, see FIG. 1. On the inside of said outer door is a pair of filter medium frames, 18, with conventional air filter media disposed therein. See FIG. 14. Inside the transformer compartment 14, is a conventional 480 volt multi-phase transformer, sized and specified by the customer in conjunction with applicants' assignee, to meet the needs of the specific job. It is within the skill of the art to determine a suitable transformer that is compatible with the specific VF drive employed, and the needs of the customer.

[0052] The discussion now moves to the drive zone of compartment 13. The outer doors of zone 13 are seen in closed position of FIG. 1. The doors are hinged opposed